IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#14
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APPELLANT:	JOHN G. NOETZEL ET AL.	) Group Art Unit: 1745
SERIAL NUMBER:	09/778,537	) Examiner:
FILED:	FEBRUARY 07, 2001	) Chaney, Carol Diane
FOR:	SOLID OXIDE AUXILIARY POWER UNIT REFORMATE CONTROL	) Confirmation Number 5043

APPEAL BRIEF

1. THE REAL PARTY IN INTEREST

The real party in interest in this application is Delphi Technologies, Inc. Ownership by Delphi Technologies, Inc. is established by assignment document recorded for this application on February 07, 2001, on Reel 011570 Frame 0824.

2. RELATED APPEALS AND INTERFERENCES

Appellants know of no related patent applications or patents under any appeal or interference proceeding.

3. STATUS OF CLAIMS

Currently, Claims 1 - 28 and 31 – 56 are pending. The Examiner has rejected Claims 1 - 28 and 31 – 42 as anticipated under 35 U.S.C. §102(e) by Okada et al., U.S. Patent No. 6,266,576. The Examiner has rejected Claim 43 - 56 as unpatentable under 35 U.S.C. §103(a) as being unpatentable over Okada et al., U.S. Patent No. 6,266,576.

4. STATUS OF AMENDMENTS

No amendments have been submitted following final rejection.

5. SUMMARY OF THE INVENTION

A method and system (10) for controlling reformate (102) delivered to an electrochemical cell (50) in an electric power system (10). The system (10) comprises: a reformate pressure sensor (22) disposed in the reformate (102) and configured to measure reformate pressure. (Page 5, line 20). Fuel is supplied to the reformer (20), and processed resulting in a reformate (102), which is supplied to the electrochemical cell (50) (a solid oxide fuel cell in one embodiment). (Page 4, line 3). The reformate 102 is typically metered and controlled via a fixed orifice or valve 40, which restricts the flow of the reformate 102 to the SOFC 50. A controllable valve (60) configured to control the flow of reformate (102) to the electrochemical cell (50); and a controller (30) coupled to the reformate pressure sensor (22) and the controllable valve (60). (Page 5, lines 22 - 27). The controller (30) receives a reformate pressure signal (104) from the reformate pressure sensor (22), a controllable valve position signal (106) from the controllable valve (60), and transmits a controllable valve command (108) to the controllable valve (60). (Page 5, lines 20 – 22 and 24 – 27). In another embodiment, the method and system further include receiving a metered reformate pressure signal (114) representative of a metered reformate pressure (112) and actuating the controllable valve (60) in response to a reformate pressure signal (102), a metered reformate pressure signal (114), a desired reformate pressure signal (110), and said controllable valve position signal (106). (Page 8 line 31-Page 9, line 7).

6. ISSUES

There are three issues, which are related. First, whether the Examiner's rejection of Claims 1 – 29, and 31 – 46 under 35 U.S.C. §102(e) as anticipated by Okada et al. U.S. Patent No. 6,266,576 is improper. Second, whether the Examiner's rejection of Claim 43 - 56 as unpatentable under 35 U.S.C. §103(a) over Okada et al, U.S. Patent No. 6,266,576 is improper. Third, whether the Examiner's justification for the above rejections based on inherency is improper.

7. GROUPING OF CLAIMS

There are the following groupings of claims:

Claims 1,2, 43, 44, and 50, 51 comprise the first group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al.

Claims 3, 4, 5, 7, 8, and 9 comprise the second group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: actuating in response to a desired controllable valve position value.

Claims 6, 45, and 42 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: actuating in response to a desired controllable valve position value."

Claims 10 – 11, 12 - 16, 46 and 53 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: actuating is responsive to a desired controllable valve position error.

Claims 17, 18 – 22, 37, 47, 48 - 49, 54 and 55 - 56 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: receiving a metered reformate pressure signal representative of the metered reformate pressure.

Claims 23 and 24 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: said controller receives a controllable valve position signal from a controllable valve.

Claims 25, 26, and 27 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: said controllable valve command is in response to a desired controllable valve position value.

Claims 28 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: said controllable valve command responsive to a controllable valve position error.

Claims 31, 32, 33-36 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: said controllable valve command responsive to a controllable valve position error.

Claims 37, 38 - 42 comprise another group, which stand or fall together under the Examiner's contested rejection of these claims under 35 U.S.C. §102(e) as being anticipated by Okada et al. These claims are separately patentable because the cited reference does not teach: a metered reformate pressure sensor coupled to said controller and configured to measure reformate pressure at said electrochemical cell, nor does Okada et al. teach said controllable valve command is also responsive to a metered reformate pressure signal.

Claims 43 - 56 comprise the final group, which stand or fall together under the Examiner's contested rejection under 35 U.S.C. §103(a) as being unpatentable over Okada et al.

8. ARGUMENT

A. Claims 1 – 28 and 31 - 42 are not anticipated by Okada et al.

Claims 1 – 28 and 31 - 42 stand rejected under 35 U.S.C. §102(e) as being anticipated by Okada et al. (U.S. Patent 6,266,576). The Office Action explanation relies on the rejection in the first office action and suggests that:

> "Okada et al. disclose a fuel cell system. The system includes a hydrogen supply means having a reformer, a variable valve (10) for regulating the amount of methanol supplied to the reformer (9), and a pressure regulator (11) for maintaining the pressure of hydrogen supplied from the reformer to the fuel cell (5) at a constant pressure, and a reservoir tank (12) for storing hydrogen to be supplied to the fuel cell. The fuel cell system includes an electric generation managing means (7), which is a control system. As shown in Figure 1, the reservoir tank 12 is in fluid communication with the reformer, and therefore the pressure of the reservoir tank and the reformer will be identical. (Column 8, lines 36-48.)

> The electric generation managing means controls the system processes, which maintain pressure in the reservoir at a target pressure. The electric generation managing means detects the pressure of the reservoir tank and reformer, and uses this information to adjust the variable valve. (Column 9, lines 26-52.) Both feed-forward and feed-back control systems are used. (Note column 10, lines –9 and lines 43-52.)" From 1st Office Action dated October 02, 2002.

The Appellants contend that Okada et al., (U.S. Patent 6,266,576) hereinafter "Okada et al." does not disclose or teach each of the elements of the invention as claimed in the instant application. While Okada et al. may disclose several similar elements of the system as claimed, in each instance outlined herein, Okada et al. does not disclose the claimed elements.

To anticipate a claim under 35 U.S.C. §102, a single source must contain all of the elements of the claim. *Lewmar Marine Inc. v. Barient, Inc.*, 827 F.2d 744, 747, 3 U.S.P.Q.2d 1766, 1768 (Fed. Cir. 1987), cert. denied, 484 U.S. 1007 (1988). Moreover, the single source must disclose all of the claimed elements "arranged as in the claim." *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749 F.2d 707, 716, 223 U.S.P.Q. 1264, 1271 (Fed. Cir. 1984). Missing elements may not be supplied by the knowledge of one skilled in the art or the disclosure of another reference. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 780, 227 U.S.P.Q. 773, 777 (Fed. Cir. 1985).

With regard to Claims 1, 43, and 50, Appellants contend that Okada et al. does not disclose or teach, "**receiving a controllable valve position signal** from a controllable valve." Nor does Okada et al. disclose or teach "actuating a controllable valve in response to ... said controllable valve position signal." The Examiner has further suggested that the pressure regulator 11 of Okada et al. is a controllable valve as claimed in the instant invention. The Appellants disagree. The pressure regulator 11 taught by Okada et al is just that, a regulator. There is no teaching that the valve apparatus of the pressure regulator 11 is controllable by the electric generation managing means 7 taught therein. In fact, it is not. The pressure regulator 11 can only respond to the output pressure sensed thereby. In addition, there is no teaching in Okada et al., that the pressure regulator 11 includes a position sensor to provide position feedback, nor does Okada et al. teach that the pressure regulator 11 is responsive to such a position. Moreover, there is no teaching in Okada et al. that the pressure regulator can be responsive to "a reformate pressure signal, a desired reformate pressure, **and a controllable**

valve position signal" as claimed. On the contrary, the controllable valve of the claimed invention is controlled in response to a controllable valve position signal. Moreover the controllable valve is just that, controllable, and responsive to a command signal. Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claims 1, 43, and 50. Thus, the rejections of Claims 1, 43, and 50 are improper and the rejections should be withdrawn.

Claims 2 – 22, 44 – 49, and 51 - 56 include the same limitations as Claims 1, 43, and 50 respectively and therefore, are allowable and improperly rejected. Thus, the rejection of Claims 2 – 22, 44 – 49, and 51 - 56 should be withdrawn. Moreover, Claims 2 – 22, 44 – 49, and 51 - 56 depend from Claims 1, 43, and 50 respectively, which are allowable, and thus are allowable as well.

With regard to Claim 3, Appellants contend that Okada et al. does not disclose or teach, "said actuating is in response to a desired controllable valve position value." Further, the pressure regulator 11 in Okada et al. is not responsive to a desired controllable valve position value. The pressure regulator is, at best, responsive to the output pressure. In fact, it is not even responsive to the input pressure, with the exception of attenuating the input pressure to the predetermined, non-modifiable, regulated value as fixed by the construction of the regulator 11. (See Col. 8, lines 43 – 46) Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claim 3. Thus, the rejection of Claim 3 is improper and the rejection should be withdrawn.

Claims 4, 5, 7, 8, and 9 include the same limitation as Claim 3 and therefore are allowable and improperly rejected. Thus, the rejections of Claims 4, 5, 7, 8, and 9 should be withdrawn. Moreover, Claims 4, 5, 7, 8, and 9 depend from Claim 3, which is allowable, and thus are allowable as well.

With regard to Claims 6, 45, and 52 Appellants contend that Okada et al. does not disclose or teach, "said actuating is responsive to a controllable valve position error." Nor does Okada et al. disclose or teach, "said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claims 6, 45, and 52. Thus, the rejections of Claims 6, 45, and 52 are improper and the rejections should be withdrawn.

With regard to Claims 10 - 11, 46, and 53, Appellants contend that Okada et al. does not disclose or teach "said actuating is responsive to a controllable valve command." Nor does Okada et al. disclose or teach, "said controllable valve command is responsive to a controllable valve position error." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claims 10 - 11, 46, and 53. Thus, the rejections of Claim 10 - 11, 46, and 53 are improper and the rejections should be withdrawn.

Claims 12 - 16 include the same limitation as Claim 11 and therefore are allowable and improperly rejected. Thus, the rejection of claims 12 - 16 should be withdrawn. Moreover, Claims 12 - 16 depend from Claim 11, which is allowable, and thus are allowable as well.

With regard to Claims 17, 37, 47, and 54, Appellants contend that Okada et al. does not disclose or teach "receiving a metered reformate pressure signal representative of the metered reformate pressure." Nor does Okada et al. disclose or teach, "actuating said controllable valve in response to said ... metered reformate pressure signal,..." It should be noted that the "metered" reformate pressure as claimed is based on the pressure **downstream** of the controllable valve. Okada et al., does not disclose or teach measurement of a pressure signal downstream of the pressure regulator 11. Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claims 17, 37, 47, and 54. Thus, the rejections of Claims 17, 47, and 54 are improper and the rejections should be withdrawn.

Claims 18 – 22, 48 - 49, and 55 - 56 include the same limitation as Claim 17, 47, and 54 respectively and therefore are allowable and improperly rejected. Thus, the rejection of Claims 18 – 22, 48 - 49, and 55 - 56 should be withdrawn. Moreover, Claims 18 – 22, 48 - 49, and 55 - 56 depend from Claims 17, 47, and 54 respectively which are allowable, and thus are allowable as well.

Similarly, with regard to Claims 23, Appellants contend that Okada et al. does not disclose or teach, "said controller receives a controllable valve position signal from said controllable valve." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claim 23. Thus, the rejection of Claim 23 is improper and the rejection should be withdrawn.

Likewise, Claims 24 – 42 include the same limitations as Claim 23 and therefore, are allowable and improperly rejected. Thus, the rejection of Claims 24 – 42 should be withdrawn. Moreover, Claims 24 – 42 depend from Claim 23, which is allowable, and thus are allowable as well.

With regard to Claim 25, Appellants contend that Okada et al. does not disclose or teach, "said controllable valve command is in response to a desired controllable valve position value." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate the claim. Thus, the rejection of Claim 25 is improper and the rejection should be withdrawn.

Claims 26 and 27 include the same limitation as Claim 25 and therefore are allowable and improperly rejected. Thus, the rejections of Claims 26 and 27 should be withdrawn. Moreover, Claims 26 and 27 depend from Claim 25, which is allowable, and thus are allowable as well.

With regard to Claim 28, Appellants contend that Okada et al. does not disclose or teach, "said controllable valve command is responsive to a controllable valve position error." Nor does Okada et al. disclose or teach, "said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claim 28. Thus, the rejection of Claim 28 is improper and the rejection should be withdrawn.

With regard to Claims 31 and 32, Appellants contend that Okada et al. does not disclose or teach, "said controllable valve command is responsive to a controllable valve position error." Nor does Okada et al. disclose or teach, "said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claims 31 and 32. Thus, the rejections of Claim 31 and 32 are improper and the rejections should be withdrawn.

Claims 33 - 36 include the same limitations as Claim 31 and therefore are allowable and improperly rejected. Thus, the rejection of claims 33 - 36 should be withdrawn.

Moreover, Claims 33 - 36 depend from Claim 31, which is allowable, and thus are allowable as well.

With regard to Claim 37, Appellants contend that Okada et al. does not disclose or teach "a metered reformate pressure sensor coupled to said controller and configured to measure reformate pressure at said electrochemical cell." Nor does Okada et al. disclose or teach, "...said controllable valve command is also responsive to said metered reformate pressure signal." Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot anticipate Claim 37. Thus, the rejection of Claim 37 is improper and the rejection should be withdrawn.

Claims 38 – 42 include the same limitation as Claim 37 and therefore are allowable and improperly rejected. Thus, the rejections of Claims 38 – 42 should be withdrawn. Moreover, Claims 38 – 42 depend from Claim 37, which is allowable, and thus are allowable as well.

B. Claims 43 - 56 are not obvious in view of Okada et al.

Claims 43 - 56 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Okada et al. U. S. Patent No. 6,266,576.

Appellants respectfully contend for the reasons identified above that the Okada et al. does not disclose or teach one or more of the elements claimed and therefore cannot render the claims unpatentable.

Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Further, even assuming that all elements of an invention are disclosed in the prior art, an Examiner cannot establish obviousness by locating references that describe various aspects of a patent applicant's invention without also providing evidence of the motivating force which would have impelled one skilled in the art to do what the patent applicant has done. *Ex parte Levengood*, 28 U.S.P.Q. 1300 (Bd. Pat. App. Int. 1993). The references, when viewed by themselves and not in retrospect, must suggest the invention. *In Re Skoll*, 187 U.S.P.Q. 481 (C.C.P.A. 1975).

Appellants respectfully contend for the reasons identified above that the Okada et al. does not disclose or teach one or more of the elements claimed and therefore cannot render the claims unpatentable. Therefore, because Okada et al. does not disclose or teach an element of the claimed invention, it cannot render Claims 43 – 56 unpatentable. Thus, the rejections of Claims 43 - 56 are improper and the rejections should be withdrawn.

C. The claimed elements of the invention are not inherent in Okada et al.

To refute to the arguments raised in response to the 1st Office Action dated October 02, 2002, the Final Office Action explanation suggests, that the elements cited to traverse the rejection are inherent in Okada et al. Appellants respectfully disagree. Appellants further contend that the Final Office Action does not provide the required justification that the element relied upon is necessarily present in the cited art.

"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is **necessarily present** in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency however, may not be established by probabilities or possibilities. The mere fact that a certain thing **may** result from a give set of circumstances **is not sufficient**.' " (Emphasis Added) In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-1 (Fed Cir. 1999). MPEP §2112

Appellants contend that the explanation in the Final Office Action stating that: "The control system inherently requires receipt of a signal corresponding to the position of the controllable valve in order to operate." mischaracterizes the teachings of Okada et al. and further, is not supported by any evidence to indicate that the missing descriptive matter is **necessarily present** in the teachings of Okada et al. For example, Okada et al. does not necessarily include a controllable valve position signal. Appellants contend that the Examiner's assertion is in error. A "signal corresponding to the position of the controllable valve" is not included, taught, or required by Okada et al. Okada et al. teaches a pressure regulator. Pressure regulators do not require or utilize "a signal indicative of the position of the valve to operate". As suggested during the telephone interview, it should be appreciated, that a pressure regulator will place the valve element in ***any*** position required to result in the regulated pressure at the output. This is most akin to a closed loop control on output pressure,

not a closed loop control responsive to position as the Examiner suggests. The position of the valve is not necessary or required in Okada et al., therefore the Examiner has not met the necessary burden of proof for a showing of inherency. Thus, the rejection based upon an assertion of inherency is improper and should be withdrawn. Therefore, Claims 1, 43, and 50 are allowable.

With respect to Claim 3, the Examiner in the Final Office Action states: "that the process of 'actuating a controllable valve in response to a desired controllable valve position value' describes adjusting the flow through a valve, which is inherent to the Okada et al. disclosure." Appellants contend once again that the Examiner has not satisfied the burden of proof for showing of inherency as prescribed by *In re Robertson*. The explanation in the Final Office Action provides no showing that Okada et al. necessarily includes the element "said actuating is in response to a desired controllable valve position value." In fact, as stated earlier the pressure regulator 11 in Okada et al. is not responsive to a desired controllable valve position value. Therefore, because the element cited is not necessarily present in Okada et al. the Examiner has not met the burden of proof for inherency. Thus, the rejection of Claim 3 is improper and the rejection should be withdrawn.

With regard to Claims 6, 45, and 52 Appellants contend that Okada et al. does not disclose or teach, "said actuating is responsive to a controllable valve position error." Nor does Okada et al. disclose or teach, "said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value." With regard to Claims 10 - 11, 46, and 53, Appellants contend that Okada et al. does not disclose or teach, "said actuating is responsive to a controllable valve command." Nor does Okada et al. disclose or teach, "said controllable valve command is responsive to a controllable valve position error." The Examiner in the Final Office Action states: "However, Okada et al. disclose closed-loop feed-forward and feed-back control systems. Closed loop control systems compare are desired value of a parameter (e.g. valve position) with a deviation or error in the measured value(d) of that parameter. Note (Citing Perry)...The disclosure by Okada et al. of control systems inherently discloses Appellants claim limitations require valve position adjustment in response to valve position errors."

Appellants contend once again, that the Examiner has not satisfied the burden of proof for showing of inherency as prescribed by *In re Robertson*. The explanation in the Final

Office Action provides no showing that Okada et al. necessarily includes the element "said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value." Nor as the Final Office Action provided any showing of the elements "said actuating is responsive to a controllable valve command." nor "said controllable valve command is responsive to a controllable valve position error."

In addition, contrary to the Examiner's assertion, just because Okada et al. discloses a "closed-loop feed-forward and feed-back control systems" and Perry teaches that "Closed loop control systems compare are desired value of a parameter (e.g. valve position) with a deviation or error in the measured value (d) of that parameter." It does not follow that Okada et al. **necessarily includes** the claim limitation as required by *In re Robertson.* For example, there is no evidence presented that the closed loop system of Okada et al includes a loop closure based on a valve position signal. In fact, quite the contrary, the loop closures disclosed in Okada et al. do not include any such reference to valve position. The loop closures disclosed are based on the required electricity and thereby the fuel supplied to the reformer. In fact, there is no closed loop control of the reformate supplied to the fuel cell based on the valve position of the controllable valve as in the claimed invention.

Therefore, because the elements cited is not necessarily present in Okada et al. the Examiner has not met the burden of proof for inherency. Thus, the rejections of Claims 6, 45, and 52 are improper and the rejection should be withdrawn. Following similar reasoning, the rejections of Claims 10 - 11, 46, and 53 are improper and the rejection should be withdrawn.

D. Conclusion

For the reasons cited above, Appellants respectfully submit that the claims are allowable and the application is in condition for allowance. Appellants respectfully request reversal of the outstanding rejections and allowance of this application.

The claims were not amended to overcome the prior art and therefore, no presumption should attach that either the claims have been narrowed over those earlier presented, or that subject matter or equivalents thereof to which the Appellants are entitled has been surrendered.

In the event the Examiner has any queries regarding the submitted arguments, the undersigned respectfully requests the courtesy of a telephone conference to discuss any matters in need of attention.

If there are additional charges with respect to this matter or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully Submitted,

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9. APPENDIX A

Appealed Claims

Claim 1. A method for controlling reformate delivered to an electrochemical cell in an electric power system, comprising:

receiving a reformate pressure signal from a reformate pressure sensor;

receiving a controllable valve position signal from a controllable valve;

actuating a controllable valve in response to said reformate pressure signal, a desired reformate pressure, and said controllable valve position signal.

Claim 2. The method of Claim 1 wherein said actuating is responsive to a reformate pressure error signal responsive to the difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 3. The method of Claim 2 wherein said actuating is in response to a desired controllable valve position value.

Claim 4. The method of Claim 3 wherein said desired controllable valve position value is responsive to said reformate pressure error signal.

Claim 5. The method of Claim 4 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 6. The method of Claim 1 wherein:

said actuating is responsive to a controllable valve position error; and

said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 7. The method of Claim 3 wherein said actuating is responsive to a controllable valve command.

Claim 8. The method of Claim 7 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 9. The method of Claim 8 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 10. The method of Claim 1 wherein said actuating is responsive to a controllable valve command.

Claim 11. The method of Claim 10 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 12. The method of Claim 11 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 13. The method of Claim 11 wherein said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 14. The method of Claim 13 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 15. The method of Claim 14 wherein said reformate pressure error signal is responsive to a difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 16. The method of Claim 14 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 17. The method of Claim 1 further including:

receiving a metered reformate pressure signal representative of the metered reformate pressure;

actuating said controllable valve in response to said reformate pressure signal, said metered reformate pressure signal, said desired reformate pressure signal, and said controllable valve position signal.

Claim 18. The method of Claim 17 wherein said actuating is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 19. The method of Claim 18 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.

Claim 20. The method of Claim 18 wherein said pressure differential signal is utilized to index a look up table to yield said actual mass flow signal.

Claim 21. The method of Claim 20 wherein said actuating is responsive to a mass flow error signal responsive to the difference between a theoretical mass flow signal and said actual mass flow signal.

Claim 22. The method of Claim 21 wherein said actuating is responsive to a desired controllable valve position value which is reduced if said mass flow error signal is greater than a first mass flow error threshold and increased if said reformate pressure error signal is less than a second mass flow error threshold.

Claim 23. A system for controlling reformate delivered to an electrochemical cell in an electric power system comprising:

a reformate pressure sensor disposed in said reformate and configured to measure reformate pressure at a reformer;

a controllable valve configured to control the flow of reformate to said electrochemical cell responsive to a controllable valve command; and

a controller coupled to said reformate pressure sensor and said controllable valve, and

wherein said controller receives a reformate pressure signal from said reformate pressure sensor, a controllable valve position signal from said controllable valve, and transmits said controllable valve command responsive to at least one of said reformate pressure signal, a desired reformate pressure signal, and said controllable valve position signal.

Claim 24 The system of Claim 23 wherein said controllable valve command is responsive to a reformate pressure error signal responsive to the difference between said reformate pressure signal and a desired reformate pressure signal representative of a desired reformate pressure.

Claim 25. The system of Claim 23 herein said controllable valve command is responsive to a desired controllable valve position value.

Claim 26. The system of Claim 25 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 27. The system of Claim 26 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 28. The system of Claim 23 wherein

said controllable valve command is responsive to a controllable valve position error; and

said controllable valve position error is responsive to a difference between a measured controllable valve position signal and a desired controllable valve position value.

Claim 29. (Cancelled).

Claim 30. (Cancelled).

Claim 31. The system of Claim 23 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 32. The system of Claim 31 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 33. The system of Claim 31 wherein said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 34. The system of Claim 33 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 35. The system of Claim 34 wherein said reformate pressure error signal is responsive to a difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 36. The system of Claim 35 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 37. The system of Claim 23 further including:

a metered reformate pressure sensor coupled to said controller and configured to measure reformate pressure at said electrochemical cell;

wherein said controller further receives a metered reformate pressure signal generated by said metered reformate pressure sensor and said controllable valve command is also responsive to said metered reformate pressure signal.

Claim 38. The system of Claim 37 wherein said controllable valve command is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 39. The system of Claim 38 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.

Claim 40. The system of Claim 38 wherein said pressure differential signal is utilized to index a look up table to yield said actual mass flow signal.

Claim 41. The system of Claim 37 wherein said actuating is responsive to a mass flow error signal responsive to the difference between a theoretical mass flow signal and said actual mass flow signal.

Claim 42. The system of Claim 41 wherein said actuating is responsive to a desired controllable valve position value which is reduced if said mass flow error signal is greater than a first mass flow error threshold and increased if said reformate pressure error signal is less than a second mass flow error threshold.

Claim 43. A storage medium encoded with a machine-readable computer program code for controlling reformate delivered to an electrochemical cell in an electric power system, said storage medium including instructions for causing a computer to implement a method comprising:

receiving a reformate pressure signal from a reformate pressure sensor;

receiving a controllable valve position signal from a controllable valve;

actuating a controllable valve in response to said reformate pressure signal, a desired reformate pressure, and said controllable valve position signal.

Claim 44. The storage medium of Claim 43 wherein said actuating is responsive to a reformate pressure error signal responsive to the difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 45. The storage medium of Claim 43 wherein

said actuating is responsive to a controllable valve position error; and

said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 46. The storage medium of Claim 43 wherein said actuating is responsive to a controllable valve command.

Claim 47. The storage medium of Claim 43 further including instructions for causing a computer to implement a method comprising:

receiving a metered reformate pressure signal representative of the metered reformate pressure;

actuating said controllable valve in response to said reformate pressure signal, said metered reformate pressure signal, said desired reformate pressure, and said controllable valve position signal.

Claim 48. The storage medium of Claim 47 wherein said actuating is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 49. The storage medium of Claim 48 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.

Claim 50. A computer data signal for controlling reformate delivered to an electrochemical cell in an electric power system, said computer data signal comprising code configured to cause a computer to implement a method comprising:

receiving a reformate pressure signal from a reformate pressure sensor;

receiving a controllable valve position signal from a controllable valve;

actuating a controllable valve in response to said reformate pressure signal, a desired reformate pressure, and said controllable valve position signal.

Claim 51. The computer data signal of Claim 50 wherein said actuating is responsive to a reformate pressure error signal responsive to the difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 52. The computer data signal of Claim 50 wherein

said actuating is responsive to a controllable valve position error; and

said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 53. The computer data signal of Claim 50 wherein said actuating is responsive to a controllable valve command.

Claim 54. The computer data signal of Claim 50 further including code configured to cause a computer to implement a method comprising:

receiving a metered reformate pressure signal representative of the metered reformate pressure;

actuating said controllable valve in response to said reformate pressure signal, said metered reformate pressure signal, said desired reformate pressure, and said controllable valve position signal.

Claim 55. The computer data signal of Claim 54 wherein said actuating is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 56. The computer data signal of Claim 55 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.